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(72)Inventor : **TOMOTAKI KATSURA**

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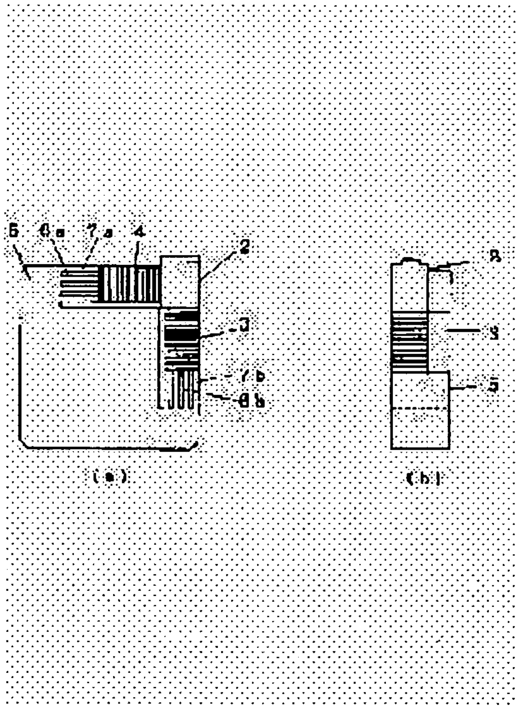
(54) ULTRA-PRECISE POSITIONING DEVICE



(57)Abstract:

PROBLEM TO BE SOLVED: To attain precise positioning by dissipating the force applied to the perpendicular direction to the laminating direction of a piezoelectric element which constitutes a clamping element and a feeding element, thus increasing the service life and the displacement of the piezoelectric element.

SOLUTION: A clamp element 3 where piezoelectric elements are laminated in the perpendicular direction to the traveling direction of a traveling body is fixed onto one end surface of a clamp block 2. A feeding element 4 where the piezoelectric elements are laminated in the traveling direction of the traveling body is fixed onto the other end surface of the clamp block 2. Longitudinal grooves 6b which have a prescribed depth and width respectively are provided at a stationary block 5 in the laminating direction of the piezoelectric element which constitutes the clamp element 3, from the fixed surface of the clamp element 3 and the stationary block 5. Longitudinal grooves 6a are provided at the feeding element 4 in the same way as the longitudinal grooves 6b. A plurality of thin plates 7a, 7b are formed between the longitudinal grooves 6a, 6b. It is thus possible to dissipate the force in the traveling direction and increase the service life and the displacement of the piezoelectric element for ultra-precise positioning.

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[Date of registration]	
[Number of appeal against examiner's decision of rejection]	
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CLAIMS

[Claim(s)]

[Claim 1] In the ultraprecise pointing device which repeats by turns a series of processings in which it sends in the migration direction if a mobile is pinched in two or more delivery units arranged in the migration direction of a mobile, for every delivery unit, and performs them The clamping block of the couple to which said delivery unit pinches said mobile, The clamp element of the couple which fixed to the end side of this clamping block, and carried out the laminating of the piezoelectric device in the direction vertical to the migration direction of said mobile, The delivery element of the couple which fixed to another end face of said clamping block, and carried out the laminating of the piezoelectric device in the migration direction of said mobile, The 1st distortion dissipation section which it fixes [1st] to the other end side of this delivery element, and makes the force of a direction vertical to the migration direction of said mobile by telescopic motion of said clamp element dissipate, the 2nd distortion dissipation section which it fixes [2nd] to the other end side of said clamp element, and makes the force of the migration direction of said mobile by telescopic motion of said delivery element dissipate -- this -- the ultraprecise pointing device characterized by having and constituting the fixed block of the couple which arranged the 2nd distortion dissipation section and said 1st distortion dissipation section in the edge.

[Claim 2] Said 1st distortion dissipation section and said 2nd distortion dissipation section By giving the fluting which has the predetermined depth and predetermined width of face respectively to said fixed block in the direction of a laminating of each piezoelectric device from the root face of said delivery element or said clamp element, and said fixed block The ultraprecise pointing device according to claim 1 characterized by constituting from two or more sheet metal which has predetermined width of face in the flexible direction of said clamp element or said delivery element respectively, and separated and arranged the clearance between predetermined spacing.

[Claim 3] Said 1st distortion dissipation section and said 2nd distortion dissipation section are an ultraprecise pointing device according to claim 2 characterized by arranging [in parallel] respectively the fixing plate which has sufficient surface area to fix with said delivery element or said clamp element respectively with the piezoelectric device of said delivery element or said clamp element at said fixed block at the edge of two or more of said sheet metal.

[Claim 4] Said 1st distortion dissipation section and said 2nd distortion dissipation section are an ultraprecise pointing device according to claim 2 or 3 characterized by giving the gutter which has the predetermined depth and predetermined width of face to said fixed block in the direction of a laminating of each piezoelectric device to the perimeter which surrounds the root face of said delivery element or said clamp element, and said fixed block respectively.

[Claim 5] Said 1st distortion dissipation section is an ultraprecise pointing device according to claim 1, 2, 3, or 4 characterized by having omitted and arranging only said 2nd distortion dissipation section in a fixed block.

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DETAILED DESCRIPTION

[Detailed Description of the Invention]
[0001]
[Field of the Invention] Especially this invention relates to the ultraprecise pointing device which can dissipate the force in which it is added in the direction vertical to the direction of a laminating of the piezoelectric device which constitutes a clamp element and a delivery element with respect to an ultraprecise pointing device.
[0002]
[Description of the Prior Art] Conventionally, there are some which used the piezoelectric device (PZT) for a kind of the feed gear of a measuring worm (Inch worm) method as an actuator. The whole ultraprecise pointing device block diagram which adopted this method as drawing 6 is shown. In drawing 6 , clamping block 2a of the couple which pinches a mobile 1, and 2b confront each other on both sides of a mobile 1. In clamping block 2a and the end side of 2b, the clamp elements 3a and 3b of the couple which carried out the laminating of the piezoelectric device in the migration direction of a mobile 1 and the vertical direction have fixed. Moreover, clamping block 2a and the delivery elements 4a and 4b of the couple which carried out the laminating of the piezoelectric device to another end face of 2b in the migration direction of a mobile 1 have fixed. And the other end side of the clamp elements 3a and 3b of a couple and the delivery elements 4a and 4b of a couple has fixed to the fixed blocks 5a and 5b of a couple. And two or more (four pieces when it is drawing 6) delivery units constituted in this appearance are arranged in the migration direction of a mobile 1.
[0003] Next, actuation of a measuring worm method is explained. Drawing 7 shows the simple block diagram of the ultraprecise pointing device at the time of using three delivery units in order to make an understanding of operation easy. Moreover, the control pattern for an ultraprecise pointing device's for moving mobile's 1 to drawing 8 round term is shown. The figure described in the upper part of drawing 8 shows timing. Moreover, the electrical-potential-difference value which impresses a phase (the period until actuation of a measuring worm method is completed a round term was expressed as a 2pi radian.) to an axis of ordinate at each piezoelectric device is shown on an axis of abscissa. Drawing 8 shows each the clamp elements 3a and 3b, the delivery elements 4a and 4b, the clamp elements 3c and 3d, the delivery elements 4c and 4d, the clamp elements 3e and 3f, and delivery elements [4e and 4f] electrical-potential-difference pattern sequentially from the top. Between timing 1 - timing 2, it is in a pinching condition the clamp elements 3a and 3b and 3e and 3f. The clamp elements 3c and 3d are having pinching canceled. The electrical potential difference is gradually impressed to the delivery elements 4a and 4b and 4e and 4f, maintaining this condition. As a result, a mobile 1 is movable. The delivery elements 4c and 4d make the variation rate small gradually in the meantime. To timing 3 (phase pi), the clamp elements 3c and 3d are changed into a pinching condition, and the clamp elements 3a and 3b and pinching of 3e and 3f are canceled. Between timing 4 - timing 5, the clamp elements 3c and 3d are in a pinching condition, and are in the condition of discharge of pinching the clamp elements 3a and 3b and 3e and 3f. The electrical potential difference is gradually impressed to the delivery elements 4c and 4d, maintaining this condition. As a result, a mobile 1 is further movable. The variation rate is

gradually made small in the meantime the delivery elements 4a and 4b and 4e and 4f. And between timing 5 - timing 6 (phase 2pi), it returns to the condition of a phase 0 by changing the clamp elements 3a and 3b and 3e and 3f into a pinching condition again. By continuing repeating actuation of this round term, an ultraprecise pointing device can drive a mobile 1 over a long stroke.

[0004] In addition, return actuation of a mobile 1 makes a pinching condition the clamp elements 3a and 3b and 3e and 3f, and cancels pinching of the clamp elements 3c and 3d. Maintaining this condition, positive voltage is impressed to the delivery elements 4c and 4d, and that variation rate is made to increase (it lengthens). This condition is maintained and the clamp elements 3c and 3d are made into a pinching condition. And the clamp elements 3a and 3b and pinching of 3e and 3f are canceled. Next, if a delivery elements [in a pinching condition / 4c and 4d] electrical potential difference is reduced in the range of positive voltage, a delivery elements [4c and 4d] variation rate will decrease, and a mobile 1 will retreat. Next, return actuation can be continuously performed by performing the same command to the clamp elements 3a and 3b in a pinching discharge condition, and 3e and 3f.

[0005]

[Problem(s) to be Solved by the Invention] by the way, a clamp element and a delivery element -- original -- a variation rate -- a variation rate practical from a piezoelectric device with a small amount -- in order to obtain an amount, it is used with the structure which carried out the laminating of the sheet metal-like thing. Consequently, although it has the sufficient reinforcement and the rigidity for a lengthwise direction (the thickness direction), in a longitudinal direction (the direction of a side face), reinforcement and rigidity become small. therefore, the variation rate of two piezoelectric devices (a clamp element and delivery element) -- in the ultraprecise pointing device which the structure (the clamp element 3 and the delivery element 4 have intersected perpendicularly and fixed through the clamping block 2 in drawing 6) which uses a direction, intersecting perpendicularly mentioned above Since the life of a piezoelectric device would be governed by the magnitude of the bending force of the bending force from a side face working to the piezoelectric device of another side, and acting on it repeatedly if the variation rate of piezoelectric device of one of the two is carried out, there was a possibility that it could not be used over long duration. Moreover, in order to prolong a life, the amount of displacement had to be lessened, and the feed rate had to be made late. This invention was made in view of such a conventional technical problem, is dissipating the force it being added in the direction vertical to the direction of a laminating of the piezoelectric device which constitutes a clamp element and a delivery element, and lengthens the life of a piezoelectric device, and it aims at offering the ultraprecise pointing device which can enlarge the amount of displacement of a piezoelectric device.

[0006]

[Means for Solving the Problem] For this reason, this invention (claim 1) is set to the ultraprecise pointing device which repeats by turns a series of processings in which it sends in the migration direction if a mobile is pinched in two or more delivery units arranged in the migration direction of a mobile, for every delivery unit, and performs them. The clamping block of the couple to which said delivery unit pinches said mobile, The clamp element of the couple which fixed to the end side of this clamping block, and carried out the laminating of the piezoelectric device in the direction vertical to the migration direction of said mobile, The delivery element of the couple which fixed to another end face of said clamping block, and carried out the laminating of the piezoelectric device in the migration direction of said mobile, The 1st distortion dissipation section which it fixes [1st] to the other end side of this delivery element, and makes the force of a direction vertical to the migration direction of said mobile by telescopic motion of said clamp element dissipate, the 2nd distortion dissipation section which it fixes [2nd] to the other end side of said clamp element, and makes the force of the migration direction of said mobile by telescopic motion of said delivery element dissipate -- this -- the fixed block of the couple which arranged the 2nd distortion dissipation section and said 1st distortion dissipation section in the edge was had and constituted.

[0007] This invention (claim 2) moreover, said 1st distortion dissipation section and said 2nd distortion dissipation section By giving the fluting which has the predetermined depth and predetermined width of face respectively to said fixed block in the direction of a laminating of each piezoelectric device from

the root face of said delivery element or said clamp element, and said fixed block It has predetermined width of face in the flexible direction of said clamp element or said delivery element respectively, and constituted from two or more sheet metal which separated and arranged the clearance between predetermined spacing.
[0008] Furthermore, this invention (claim 3) arranged respectively in parallel the fixing plate which has sufficient surface area to fix with said delivery element or said clamp element respectively with the piezoelectric device of said delivery element or said clamp element at the edge of two or more of said sheet metal at said fixed block, and, as for said 1st distortion dissipation section and said 2nd distortion dissipation section, constituted it.
[0009] Furthermore, said 1st distortion dissipation section and said 2nd distortion dissipation section gave the gutter which has the predetermined depth and predetermined width of face to said fixed block in the direction of a laminating of each piezoelectric device to the perimeter which surrounds the root face of said delivery element or said clamp element, and said fixed block respectively, and this invention (claim 4) constituted them to it.
[0010] Furthermore, said 1st distortion dissipation section omitted this invention (claim 5), and it arranged only said 2nd distortion dissipation section in the fixed block, and constituted it.
[0011]
[Embodiment of the Invention] Hereafter, the operation gestalt of this invention is explained based on a drawing. The 1st operation gestalt of this invention is shown in drawing 1 . Drawing 1 (a) is the top view of a delivery unit, and drawing 1 (b) shows the side elevation. In drawing 1 , a clamping block 2 pinches a mobile 1 in contact with a mobile 1. In the end side of a clamping block 2, the clamp element 3 which carried out the laminating of the piezoelectric device in the migration direction of a mobile 1 and the vertical direction has fixed. Moreover, to another end face of a clamping block 2, the delivery element 4 which carried out the laminating of the piezoelectric device in the migration direction of a mobile 1 has fixed. Fluting 6b which has the predetermined depth (for example, it may be about 8mm with this operation gestalt) and predetermined width of face (for example, it may be about 1mm with this operation gestalt) to a fixed block 5 in the direction of a laminating of the piezoelectric device which constitutes the clamp element 3 is given from the root face (for example, the root face is made into the magnitude of 10mm angle extent with this operation gestalt) of the clamp element 3 and a fixed block 5. Therefore, it has predetermined width of face (for example, with this operation gestalt, it may be about 2mm) in the flexible direction (the direction of a laminating of the piezoelectric device which constitutes the delivery element 4) of the delivery element 4, the clearance between predetermined spacing (for example, with this operation gestalt, it becomes about 1mm which is the width of face of fluting 6b) is separated, and sheet metal 7b of plurality (this operation gestalt 4) is engraved on the edge of a fixed block 5. Moreover, sheet metal 7a of plurality (this operation gestalt 4) is similarly engraved to the fixed block 5 from the root face of the delivery element 4 which is another edge, and a fixed block 5. The part in which this delivery element 4 was faced and two or more sheet metal 7a was given to the fixed block 5 makes the force of a direction vertical to the migration direction of the mobile 1 produced with telescopic motion of the clamp element 3 dissipate, and is equivalent to the 1st distortion dissipation section. Moreover, the part in which the clamp element 3 was faced and two or more sheet metal 7b was given to the fixed block 5 makes the force of the migration direction of the mobile 1 by telescopic motion of the delivery element 4 dissipate, and is equivalent to the 2nd distortion dissipation section.
[0012] Next, actuation is explained. By having constituted from two or more sheet metal 7a and 7b, when the force from a side face joins a piezoelectric device, sheet metal 7a and 7b deforms both the distortion dissipation section in the shape of a flat spring. A situation when sheet metal 7 deforms into drawing 2 in the shape of a flat spring is shown. The force from a side face dissipates according to this deformation. A paid part of the force from the side face to cut can do small whether as a result, it is direct to a piezoelectric device. While sheet metal 7 carries out the role of a flat spring, in order to support pinching or delivery actuation (the telescopic motion of a piezoelectric device by which the laminating was carried out is about 10-15 microns with this operation gestalt) of a mobile 1, it needs to maintain sufficient rigidity to the flexible direction of a piezoelectric device. Therefore, with this

operation gestalt, width of face of sheet metal 7 was made into about 2mm. In addition, although the construction material of a fixed block 5 is using stainless steel, whenever [dissipation / of the force] may be devised by using spring steel etc. The width of face of sheet metal 7 and the width of face of a fluting 6 are suitably designed according to the degree of telescopic motion of the clamp element 3 and the delivery element 4, or the rigidity needed. The life of a piezoelectric device can be lengthened by whether it is direct to a piezoelectric device as mentioned above, and a paid part of the force from the side face to cut having been made small. Moreover, the feed rate at the time of driving on the same frequency from the ability of the larger magnitude of telescopic motion of a piezoelectric device being taken can be made quick.

[0013] Next, the 2nd operation gestalt of this invention is shown in drawing 3 . In addition, about the same element as the 1st operation gestalt, the same sign is attached and explanation is omitted. In drawing 3 , although 6d of flutings of the predetermined depth is given in the direction of a laminating of the piezoelectric device which constitutes the clamp element 3 from the root face of the clamp element 3 and a fixed block 5 to the fixed block 5 like the 1st operation gestalt, the width of face of 6d of flutings can be opened widely (for example, with this operation gestalt, it may be about 6mm). And 7d (for example, with this operation gestalt, width of face of 7d of sheet metal is made into about 2mm) of sheet metal of two sheets is engraved on the edge of a fixed block 5 facing the clamp element 3. Moreover, fluting 6c and sheet metal of two sheets 7c are similarly engraved to the fixed block 5 from the root face of the delivery element 4 which is another edge, and a fixed block 5. The part in which this delivery element 4 was faced and sheet metal of two sheets 7c was given to the fixed block 5 makes the force of a direction vertical to the migration direction of the mobile 1 produced with telescopic motion of the clamp element 3 dissipate, and is equivalent to the 1st distortion dissipation section. Moreover, the part in which the clamp element 3 was faced and 7d of sheet metal of two sheets was given to the fixed block 5 makes the force of the migration direction of the mobile 1 by telescopic motion of the delivery element 4 dissipate, and is equivalent to the 2nd distortion dissipation section.

[0014] Next, actuation is explained. By having constituted both the distortion dissipation section from sheet metal 7c and 7d of only two sheets which opens widely Flutings [6c and 6d] width of face, and has width of face comparable as the sheet metal 7 of the 1st operation gestalt compared with the 1st operation gestalt, when the force from a side face joins a piezoelectric device, the degree which sheet metal 7 transforms in the shape of a flat spring becomes large. That is, the 2nd operation gestalt can dissipate more greatly the force which the clamp element 3 or the delivery element 4 receives from a side face from the 1st operation gestalt. However, since the plane-of-composition product of the clamp element 3 or the delivery element 4, and sheet metal 7 decreases compared with the 1st operation gestalt, the rigidity over the flexible direction of a piezoelectric device becomes small somewhat from the 1st operation gestalt.

[0015] Next, the 3rd operation gestalt of this invention is shown in drawing 4 . In addition, about the same element as the 1st operation gestalt, the same sign is attached and explanation is omitted. In drawing 4 , the fixing plates 8b and 8a which have sufficient surface area to fix with the clamp element 3 or the delivery element 4 are respectively arranged in the edge of a fixed block 5 by the piezoelectric device of the clamp element 3 or the delivery element 4, and parallel. And the flutings 6f and 6e of predetermined magnitude are given in the direction of a laminating of the piezoelectric device which constitutes the clamp element 3 or the delivery element 4 from fixing plates 8b and 8a to the fixed block 5. The width of face of Flutings 6f and 6e can be opened widely (for example, with this operation gestalt, it may be about 6mm). Therefore, the fixing plates 8b and 8a and the sheet metal 7f and 7e (for example, with this operation gestalt, width of face of sheet metal 7 is made into about 2mm) of two predetermined spacing ****** will be engraved on the edge of a fixed block 5. The part in which this delivery element 4 was faced and fixing plate 8a and sheet metal of two sheets 7e were given to the fixed block 5 makes the force of a direction vertical to the migration direction of the mobile 1 produced with telescopic motion of the clamp element 3 dissipate, and is equivalent to the 1st distortion dissipation section. Moreover, the part in which the clamp element 3 was faced and fixing plate 8b and 7f of sheet metal of two sheets were given to the fixed block 5 makes the force of the migration direction

of the mobile 1 by telescopic motion of the delivery element 4 dissipate, and is equivalent to the 2nd distortion dissipation section.
[0016] Next, actuation is explained. By having constituted both the distortion dissipation section from sheet metal 7f and 7e of only two sheets which opens widely the width of face of Flutings 6f and 6e, and has width of face comparable as the sheet metal 7 of the 1st operation gestalt compared with the 1st operation gestalt, when the force from a side face joins a piezoelectric device like the 2nd operation gestalt, the degree which sheet metal 7f and 7e transforms in the shape of a flat spring becomes large. Therefore, the degree of dissipation of the force from a side face to a piezoelectric device is large. Moreover, since the surface area by fixing between the fixing plate 8, the clamp element 3, or the delivery element 4 can take greatly, rigidity is strongly securable from the 2nd operation gestalt. In addition, width of face of a fluting 6 may be narrowed like the 1st operation gestalt, and may constitute both the distortion dissipation section from a fixing plate 8 and two or more sheet metal 7 (graphic display abbreviation). In this case, rigidity becomes strong further.
[0017] Next, the 4th operation gestalt of this invention is shown in drawing 5 . In addition, about the same element as the 1st operation gestalt, the same sign is attached and explanation is omitted. It adds to the configuration of the sheet metal 7 grade arranged in the edge of a fixed block 5 in the 1st operation gestalt thru/or the 3rd operation gestalt. To the perimeter which surrounds the root face of the clamp element 3 or the delivery element 4, and a fixed block 5 in drawing 5 The gutters 9a and 9b which have the predetermined depth (for example, it may be about 8mm with this operation gestalt) and predetermined width of face (for example, it may be about 2mm with this operation gestalt) to a fixed block 5 in the direction of a laminating of each piezoelectric device are given. The part to which this delivery element 4 was faced and gutter 9a was given to the fixed block 5 in addition to the configuration of the 1st operation gestalt thru/or the 3rd operation gestalt is equivalent to the 1st distortion dissipation section. Moreover, the part to which the clamp element 3 was faced and same gutter 9b was given is equivalent to the 2nd distortion dissipation section.
[0018] Next, actuation is explained. Although the 1st operation gestalt thru/or the 3rd operation gestalt are the configurations in the condition that the gutter 9 is not given, the depth of sheet metal 7 is governed by the depth of a fixed block 5, and it usually becomes long from the depth of the clamp element 3 or the delivery element 4 (for example, with this operation gestalt, the depth of the clamp element 3 or the delivery element 4 of the depth of a fixed block 5 is about 15mm to about 10mm). For this reason, an ununiformity and the elastic effectiveness also become small and the flat-spring effectiveness by part sheet metal 7 with the long depth of sheet metal 7 becomes unevenly [the degree of dissipation of the force from a side face to a piezoelectric device], and small. Then, in order to enlarge homogeneity and the elastic effectiveness for the flat-spring effectiveness by sheet metal 7 more by the sheet metal 7 whole, a gutter 9 is given to the perimeter surrounding the root face of the clamp element 3 or the delivery element 4, and a fixed block 5 to a fixed block 5.
[0019] In addition, although the sheet metal 7 grade constituted from each operation gestalt mentioned above as the distortion dissipation section Either the 1st [not only this but] distortion dissipation section or the 2nd distortion dissipation section It does not fix with the delivery element 4 or the clamp element 3. The rolling bearing (needlelike bearing or ball bearing) which can move in the flexible direction of the clamp element 3 or the delivery element 4 freely may be constituted in preparation for a fixed block 5 (a rolling bearing may be arranged using the edge of the clamp element 3 or the delivery element 4) (graphic display abbreviation). Furthermore, there is no need that the 1st distortion dissipation section and the 2nd distortion dissipation section consider as the not necessarily same configuration, and you may make it combine the 1st operation gestalt thru/or the 3rd operation gestalt suitably according to the degree of telescopic motion of the clamp element 3 and the delivery element 4, or the rigidity needed. Moreover, since the variation rate of the clamp element 3 receives constraint with the rigidity of a mobile 1, the force to the side face over the delivery element 4 is usually small. For this reason, the 1st distortion dissipation section which faced the delivery element 4 and was arranged in the fixed block 5 may be omitted in such a case (graphic display abbreviation).
[0020]

[Effect of the Invention] Since the 1st distortion dissipation section and the 2nd distortion dissipation section were arranged in the fixed block according to this invention (claim 1) as explained above, the force from the side face over the piezoelectric device which constitutes a delivery element or a clamp element can be dissipated. For this reason, the force from the side face in which it joins a piezoelectric device directly can be made small, and the life of a piezoelectric device can be lengthened.

[0021] Moreover, since the force from the side face in which it joins the piezoelectric device of another side directly is small even if it gives the variation rate of the maximum-permissible range to one side of a piezoelectric device, the large movement magnitude in 1 time of delivery can be taken, and the feed rate at the time of driving on the same frequency is made quickly.

[0022] Moreover, according to this invention (claim 2), since the 1st distortion dissipation section and the 2nd distortion dissipation section were constituted from two or more sheet metal, when the force from a side face joins a piezoelectric device, sheet metal deforms in the shape of a flat spring, and the force from a side face dissipates. A paid part of the force from the side face to cut can do small whether as a result, it is direct to a piezoelectric device.

[0023] Furthermore, according to this invention (claim 3), the 1st distortion dissipation section and the 2nd distortion dissipation section can keep the rigidity of the thickness direction stronger than claim 2, maintaining greatly the degree of dissipation of the force from a side face to a piezoelectric device by having formed the fixing plate which has sufficient surface area for the edge of two or more sheet metal.

[0024] Furthermore, since the 1st distortion dissipation section and the 2nd distortion dissipation section gave the fluting to the perimeter surrounding the root face of a clamp element or a delivery element, and a fixed block according to this invention (claim 4), the flat-spring effectiveness by sheet metal can be made into homogeneity with the whole sheet metal, and the larger elastic effectiveness can be taken.

[0025] Furthermore, since according to this invention (claim 5) the 1st distortion dissipation section omitted and only the 2nd distortion dissipation section was arranged in the fixed block, the force from the side face in which it joins the piezoelectric device of a clamp element can be made small in the feed direction of a mobile, with sufficient rigidity as usual maintained.

[0026]

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DESCRIPTION OF DRAWINGS

[Brief Description of the Drawings]
[Drawing 1] The block diagram of the delivery unit in which the 1st operation gestalt of this invention is shown
[Drawing 2] Drawing showing a situation when sheet metal deforms in the shape of a flat spring
[Drawing 3] The block diagram of the delivery unit in which the 2nd operation gestalt of this invention is shown
[Drawing 4] The block diagram of the delivery unit in which the 3rd operation gestalt of this invention is shown
[Drawing 5] The block diagram of the delivery unit in which the 4th operation gestalt of this invention is shown
[Drawing 6] The whole ultraprecise pointing device block diagram
[Drawing 7] The simple block diagram of an ultraprecise pointing device (three delivery units)
[Drawing 8] Drawing showing the control pattern for an ultraprecise pointing device's round term
[Description of Notations]
1 Mobile
2 Clamping Block
3 Clamp Element
4 Delivery Element
5 Fixed Block
6 Fluting
7 Sheet Metal
8 Fixing Plate
9 Gutter

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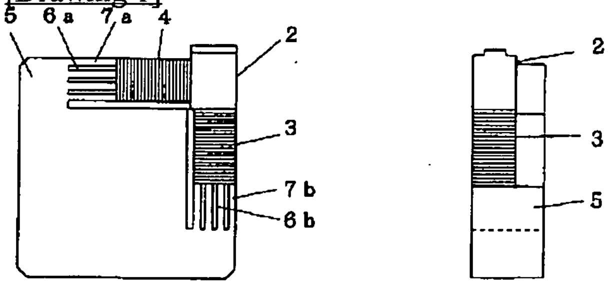
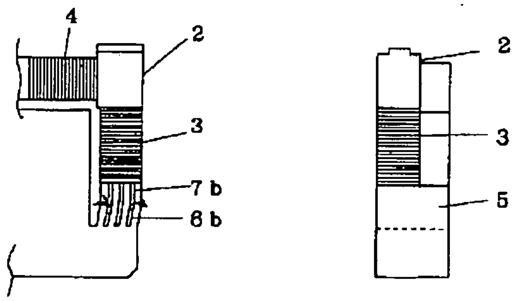
DRAWINGS

[Drawing 1]



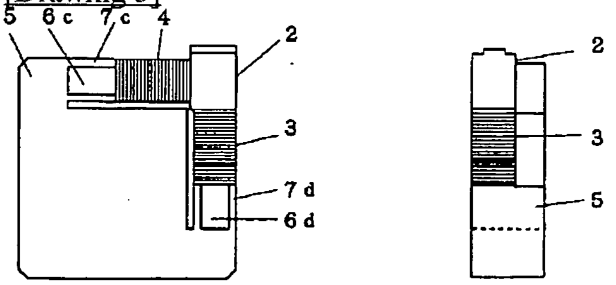
(a) (b)

[Drawing 2]



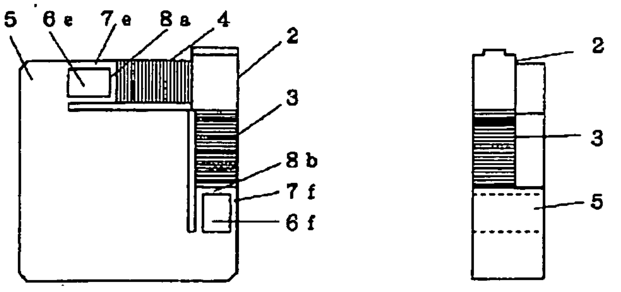
(a) (b)

[Drawing 3]



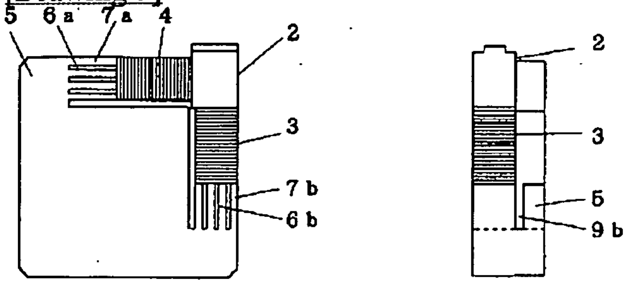
(a) (b)

[Drawing 4]



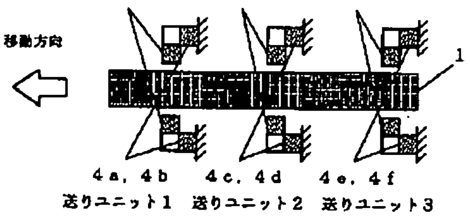
(a) (b)

[Drawing 5]

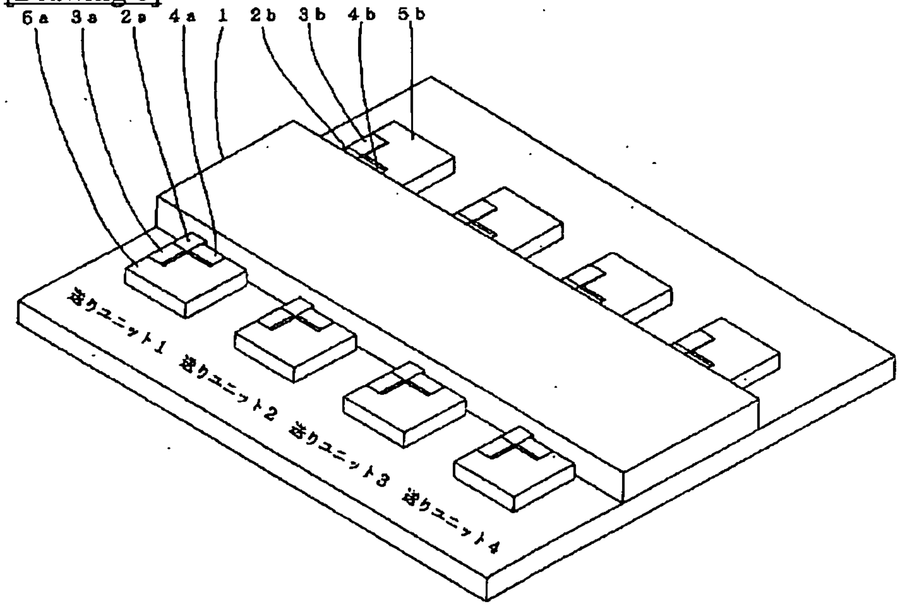


(a) (b)

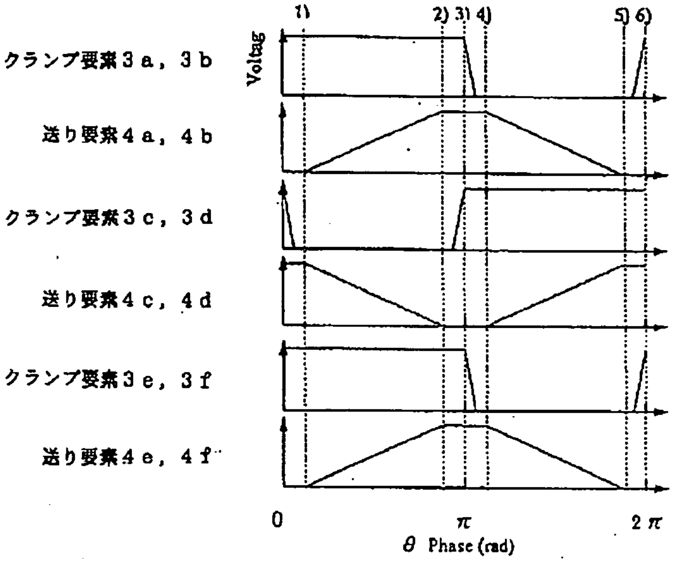
[Drawing 7]



[Drawing 6]



[Drawing 8]



[Translation done.]